



*NASA's invention improves upon past directed flux motor designs, more reliably providing more degrees of freedom, compactness, and torque control.*

### Patent Status

Patented — protected via  
US 7,999,427

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## Improved Directed Flux Motor

*Enabling compact electric motors with more torque and degrees of freedom*

### Description

Electromagnetic motors typically convert electrical energy into rotational mechanical energy and are employed across a wide array of applications. While motors represent relatively mature technology, practitioners continue to seek ways to enhance motor operation including a decrease in cost, drop in size/weight, reduction in power consumption, increase in reliability, and enhanced degrees of freedom (i.e., the number of ways a machine can move within three-dimensional space). Directed flux motors have been invented by NASA GSFC and others that increase degrees of freedom albeit at the expense of device complexity and mass. Thus, the opportunity for further improvements in directed flux motors remains.

NASA GSFC's new Directed Flux Motor utilizes the directed magnetic flux of at least one magnet through ferrous material to drive different planetary gear sets to achieve capabilities in six actuated shafts that are grouped three to each side of the motor. The flux motor also utilizes an interwoven magnet configuration which reduces overall motor size. The motor allows for simple changes to modify the torque-to-speed ratio of the gearing contained, as well as simple configurations for up to six output shafts.

### Benefits

- ▶ **More degrees of freedom:** Directed flux motors utilizing planetary gear sets offer fundamentally superior freedom of motion compared to prior designs.
- ▶ **Reduced motor size:** NASA's new Directed Flux Motor employs interwoven magnetic configurations that decrease overall device size and weight.
- ▶ **Modified torque:** NASA's new Directed Flux Motor allows for modifications in the torque-to-speed ratio of the gearing contained within the motor.
- ▶ **Enhanced manufacturability and reliability:** NASA's new Directed Flux Motor is easier to fabricate and will work more reliably than past designs.

### Applications

Direct Flux Motors can be applied to any number of electric motor applications, including aerospace, automotive, toy, and many other industries.